BRIEF NOTE

New Distribution Records for the Crayfish *Cambarus (Cambarus) ortmanni* Williamson (Decapoda: Cambaridae) With Life History Notes[1]

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INTRODUCTION

E. B. Williamson (1907) described *Cambarus (Cambarus) ortmanni* from tributaries of the Wabash River in Wells County, east-central Indiana, approximately 26 km west of the Ohio border. *C. (C.) ortmanni* was subsequently reported in Ohio (Rhoades 1944b, Clark and Rhoades 1979, Jezerinac and Thoma 1984, St. John 1982), Kentucky (Rhoades 1944a), and Wabash and Marion Counties, Indiana (Eberly 1955). Prior to this study, one specimen of *C. (C.) ortmanni* had been reported from west-central Ohio, Auglaize County, St. Marys River drainage (Rhoades 1944b).

Figure 1 shows the distribution as determined from: 1) published reports that are corroborated by museum records, 2) collection records of the United States National Museum (USNM), 3) specimens at the Ohio State University Museum of Zoology (OSUMZ), and 4) the current study.

MATERIALS AND METHODS

Collections in west-central Ohio and Indiana were made during the summer of 1987, primarily during the month of August. Those in Kentucky were made during September, 1988.

FIGURE 1. Distribution of *Cambarus (Cambarus) ortmanni* compiled from:
(▨) Previously known distribution based on published records and museum collections.
(◥) New Ohio distribution.
(○)New Kentucky county records.
(●)Disjunct collections from Muhlenberg and Ohio Counties, southwest Kentucky.

Collecting was accomplished using three different methods. Two specimens were collected with the plastic pipe trap (Norrocky 1984) and two others were taken from their burrow entrances at night with the aid of a sturdy garden trowel. By quickly thrusting the trowel into the ground at the proper place and angle, retreat into the burrow was prevented. The balance of the crayfish were captured by excavation of the burrow.

In most cases, the burrow could be excavated to the water level, the water agitated, and after a short wait, the crayfish could be seen at the water surface where it could be easily captured by hand (Hobbs 1942). This technique was modified to include the use of a 1.5 cm diameter and 120 cm long, firm rubber hose.

By probing the burrow with the hose initially, the depth to the water table and the angle of descent could be determined. The hose was again inserted into the burrow to below the water table, which prevented loose dirt from falling into the tunnel during excavation.

With the knowledge of the water depth and angle of descent, a two-handled post-hole digger was used to excavate a hole calculated to intercept the burrow at the water surface. In a few cases, when the crayfish did not respond to the agitation of the water, inserting the hose deeper into the burrow, then slowly withdrawing it would cause the crayfish to surface.

RESULTS

Of the total of 72 collections (Ohio 59, Indiana 6, and Kentucky 7), 26 yielded a total of 48 specimens of *C. (C.) ortmanni* (7 Form I males, 13 Form II males, and 28 females) from sites in Auglaize, Darke, Mercer, Miami, Shelby, and Van Wert Counties in Ohio, Adams County in Indiana, and Fleming and Rowan Counties in Kentucky (Figs. 1 and 2). Of these, all but Auglaize County are new records for this species.

Other species were collected adjacent to *C. (C.) ortmanni* at four sites. *Cambarus (L.) diogenes* was dug from burrows in Mercer County, Ohio and Rowan County, Kentucky; *Orconectes (Gremicambarus) immunis* was netted from a small woodland stream in Van Wert County, Ohio; and *Cambarus (Jugicambarus) dubius* was found in a burrow in a farm field in Fleming County, Kentucky.

In Ohio and Indiana, the burrowing crayfish, *Fallicambarus (Creaserinus) fodiens and C. (L.) diogenes* were dug from burrows in five and six, respectively, of the fourteen counties in the study area. The lotic species *O. (G.) immunis* and *Orconectes (Procericambarus) rusticus* were netted from streams in five and six of the counties, respectively. Other species found in only one or two collections were *Cambarus (Cambarus) bartonii cavatus* (1) and *Procambarus (Ortmannicus) acutus* (2). These data do not represent a complete survey of the study area, since effort was concentrated primarily on habitat thought to contain *C. (C.) ortmanni*.

In Kentucky, *C. (J.) dubius* and *C. (L.) diogenes* were also collected from Fleming and Rowan Counties. *Procambarus (Scapulicambarus) clarkii* was found at the Clark State Fish Hatchery, a few kilometers south of the village of Farmers on the Bath/Rowan County line. This species is not native to Kentucky and was probably in-

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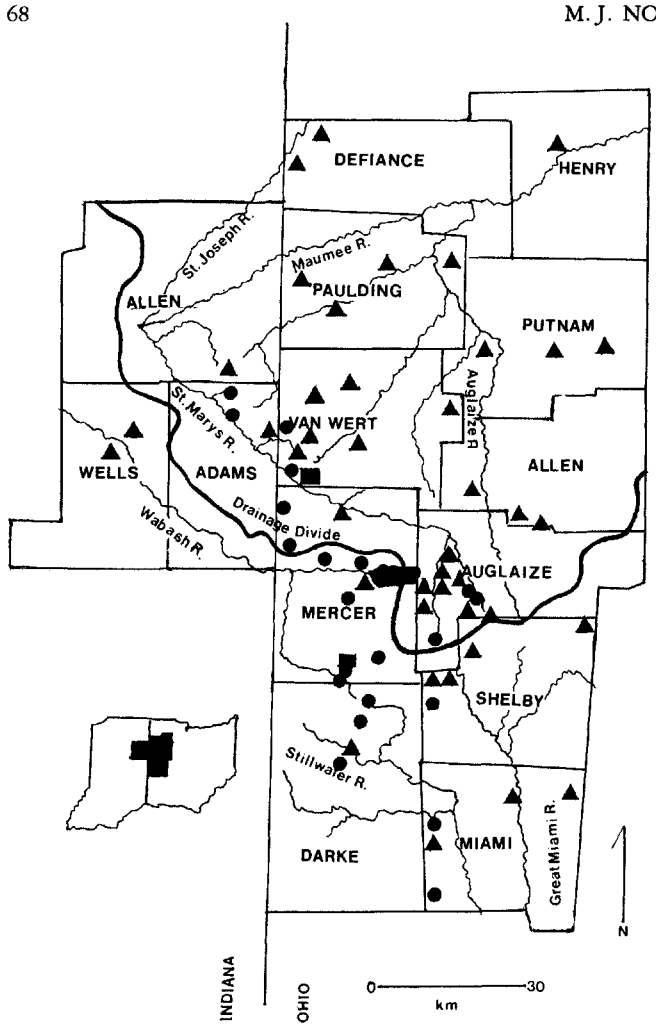

FIGURE 2. Map of counties showing collection sites in Ohio and Indiana.
(●)Sites from which *Cambarus* (*C.*) *ortmanni* was captured.
(▲)Sites from which crayfish other than *C.* (*C.*) *ortmanni* were captured.
(■)Sites from which *C.* (*C.*) *ortmanni* and another species were found.
(—) Drainage divide for Lake Erie and Ohio River.

troduced with Fathead Minnows (*Pimephales promelas*) brought to the hatchery from Arkansas.

LIFE HISTORY

The only published life history data for *C.* (*C.*) *ortmanni* is given by Williamson (1907). He reported Form I and Form II males in April and May. No ovigerous females were captured.

In Ohio, a female (41.6 mm Carapace Length [CL]) was found carrying eight 3 mm eggs on 16 August. A female (42.0 mm CL) was dug from a burrow on 01 August along with one young (10.0 mm Total Length [TL]). On 22 August another female (45.2 mm CL) was obtained from a burrow containing several young (14.0 mm TL), five of which were collected. Several juveniles 15.0 and 16.0 mm CL were collected on 08 August. The total number of young in these burrows was not determined.

A Form II male (30.8 mm CL) and a female (30.6 mm CL) were found 01 August and a 28.0 mm CL Form II male was collected on 16 August. These somewhat larger individuals are probably juveniles in their second summer just prior to a molt to adult condition.

A Form I male was captured 16 August at the water surface in a burrow and was noted as being in molt stage A1 (soft and slippery), which is the condition immediately following ecdysis (Aiken & Waddy 1987). Form I and Form II males were found throughout August.

The largest Form I and Form II males were 44.7 mm CL and 39.4 mm CL, respectively. The largest female was 44.4 mm CL. The 35.0 mm CL Form I and the 39.4 mm CL Form II males suggest that molts from Form I to Form II occur in this species. This has been recorded for other *Cambaridae* (Fielder 1972) but has not been observed in *Procambarus* (*Pennides*) *spiculifer* (Taylor 1985).

In Kentucky, two juvenile females (14.7 mm CL and 23.6 mm CL) were collected on 03 September 1988. The carapace of a 31.7 mm CL female, collected on 03 September, was noted as pliable (parchment-like) and clean (molt stage A2), indicating a recent molt (Aiken & Waddy 1987).

HABITAT

Designated a secondary burrower (Hobbs 1974), *C.* (*C.*) *ortmanni* has been found in a variety of habitats such as streams and ditches (Williamson 1907), temporary pools (Jezerinac and Thoma 1984), a burrow in a swamp along the Miami and Erie Canal (Clark and Rhoades 1979), and "from burrows around large stones along the margins of streams, smaller specimens from the fast water of riffles" (Rhoades 1944a).

During this study, *C.* (*C.*) *ortmanni* was found primarily from burrows in roadside ditches overgrown with grasses, perennial weeds, common bulrush (*Scirpus atrovirens*), and occasionally the broad-leaved cattail (*Typha latifolia*). The latter two plants in the roadside ditches in Ohio proved to be the best indicators of a suitable habitat for *C.* (*C.*) *ortmanni*.

Because of the density of the vegetation in the roadside ditches at most sites, many of the burrows were discovered by stepping on the mud mounds that had been built as the crayfish plugged the burrow, probably in response to the dry conditions.

In addition to roadside ditches, specimens in Ohio were also collected from burrows in a roadside spring (2 locations), along a small woodland stream (1), and in a ditch along a railroad track (1). The last site is unusual in that it is devoid of vegetation possibly from being flooded for extended periods. In Kentucky, one collection was made in a low area of a farm field containing soybean stubble; another was from a bare field up to 10 meters from the adjacent ditch.

DISCUSSION

The distribution of this organism (Fig. 1) suggests that the range of this crayfish is poorly understood, especially in Indiana and central Kentucky. The two disjunct collections in Muhlenberg and Ohio Counties in southwest Kentucky may be the result of introductions, but more collecting is required in the central part of the state to make this clear. There is no reason to believe that the range in Indiana does not extend westward from Ohio into the southeast corner and to the north, westward down the Wabash River basin beyond Miami County. Its presence in the St. Marys River drainage in

the Maumee River basin may represent range expansion which can only be determined through continued sampling. The collections from Fleming and Rowan Counties, Kentucky were in the Licking River drainage. *Cambarus (C.) ortmanni* has now been reported from sites in this basin from the confluence with the Ohio River to Rowan County.

The meager life history data suggest the following scenario. Egg extrusion occurs near mid-summer. Juveniles grow to about 20.0 mm CL by fall, and by the end of their second summer they are 30.0 mm to 35.0 mm and at least some molt to reproductive adults. The larger adults (39.0 mm to 44.7 mm) suggest that the life span could be three years or more.

All but six of the specimens from this study have been deposited in the Ohio State University Museum of Zoology. Those six have been retained in the personal collection of the author.

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